

The background is a deep space scene. A large, reddish-orange planet, resembling Mars, is on the right. In the foreground, a large, dark, cratered asteroid is on the left. Another smaller asteroid is visible in the upper left. A bright sun flare is in the top left corner. The text is overlaid on this scene.

# **OFF EARTH RESOURCES**

**Shattering Paradigms to Create Space Mining 2.0**

**Space Resources Roundtable, June 2024**

[mark.sonter@asteroidenterprises.com](mailto:mark.sonter@asteroidenterprises.com)

<https://offearthresources.com/>



# Shattering Paradigms to create Space Mining 2.0...

Humanity's expansion into space depends critically upon the cost-effective availability of resources in space for fuel, structures and life support. The reliance on Earth-launched resources beyond the very near term is not sustainable and ultimately constrains space development.

***OER is an Australian resource development company aiming to develop the first commercial in-space resource opportunity.***

Our extensive terrestrial resource project experience enables us to apply terrestrial resource project insights, disciplines, and processes, and thus shift the paradigm to recognise space mining projects as '**just mines**' albeit very remote ones.

The terrestrial project development process includes prospecting, exploration, trial mining and pilot plant processing to de-risk the technology for the specific case, leading to eventual full-scale production. At each step, the financial and technical uncertainties are sequentially de-risked and re-assessed before proceeding.

OER has developed a high-level concept plan for a propellant production facility, focussing on the extremely promising resource potential of Deimos the Martian moon, and is commencing the design of a bespoke resource evaluation module to collect insitu data specific to resource development decision making.

**Mark Sonter, Off Earth Mining Pty Ltd, 116 Pennine Drive, South Maclean, Queensland 4280 Australia**

email: [mark.sonter@asteroidenterprises.com](mailto:mark.sonter@asteroidenterprises.com)

ph: [\(+61\) 447 755 598](tel:+61447755598)



## Off Earth Resources

- Australian owned company developing space resource projects
- Focussed on building the new space industry
- Combines extensive resources industry experience with space industry experience
- Previous space resource development experience
- Space resource development accelerated by leveraging terrestrial mining expertise
- Initial capital raise imminent
- Practical, profitable and realistic







## ***Step-change in Launch Capacity is imminent:***

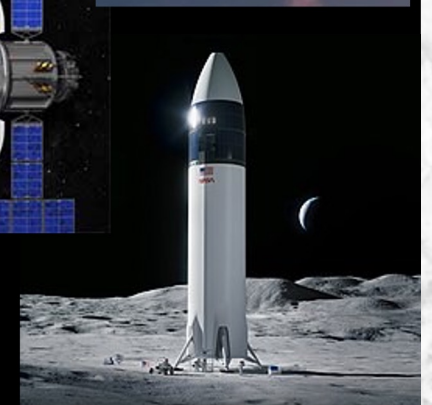
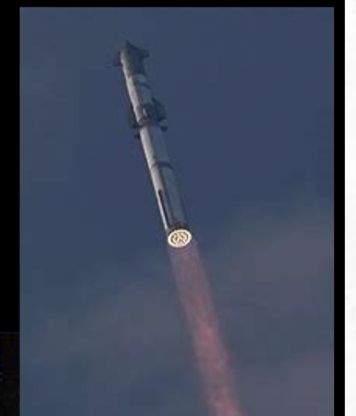
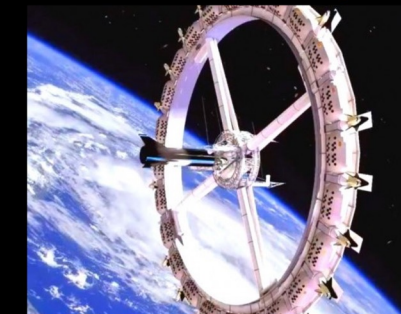
Expect massive growth in space economy and in demand for in-space commodities

***Unconstrained growth of in-space economy requires development of in-space resources***

In-space Propellant Production is the *low-hanging fruit*: the first, easiest commodity

### **Fuel & metals for the \$500B/yr Space Economy:**

- Space tourism
- Commercial space stations
- Internet-in-space
- Lunar Logistics
- Mars colonization
- Space Solar Power



***Propellant supply in orbit predicted to be a \$4B to >\$20B / year market within 10 yrs.***



# What is mining?

Exploration and assessment:



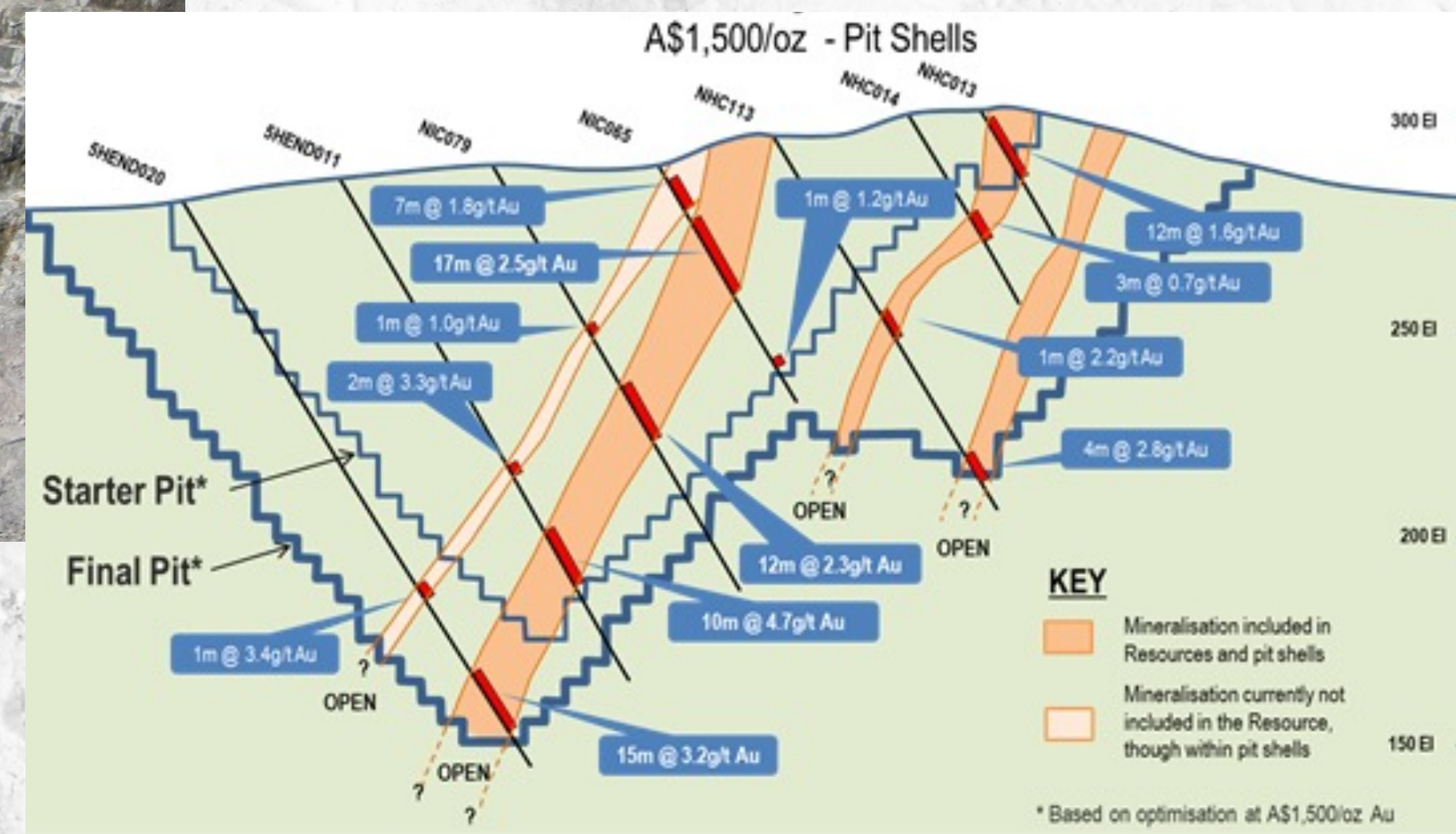
RC drillrig at Northern Minerals'  
Browns Range REE Project, Australia



In-field assay with  
hand-held XRF



Mining can be – **open pit**:



Ranger Mine (above)  
Nabarlek (top right)



**Dredge mining for mineral sands:**



**North Stradbroke Island, Queensland**

**In-Situ Leach mining for uranium:**



**Beverley Uranium, South Australia**





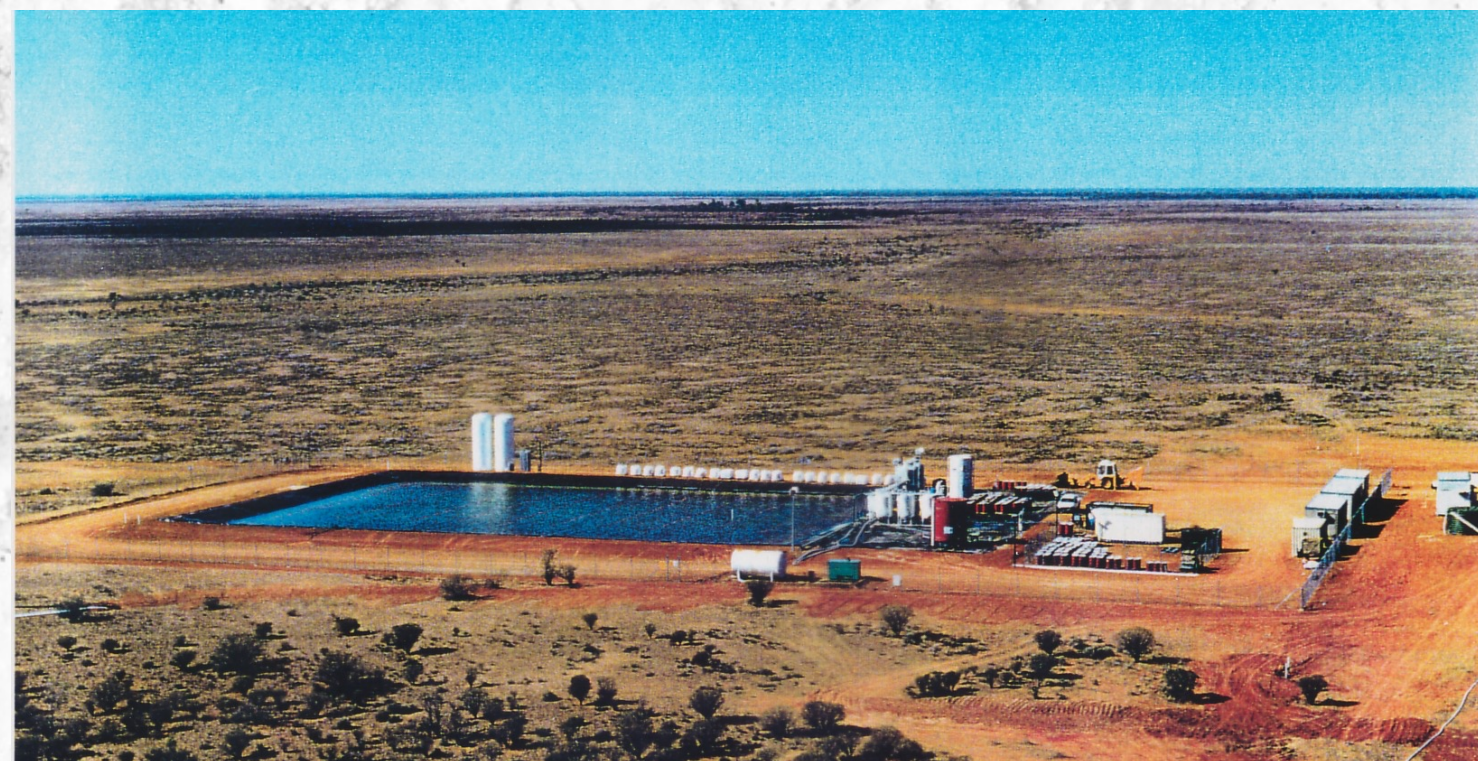
## Underground mining:

Wide variety of mining (stopping) methods: *choice depends on orebody*





# Processing / Chemical Engineering

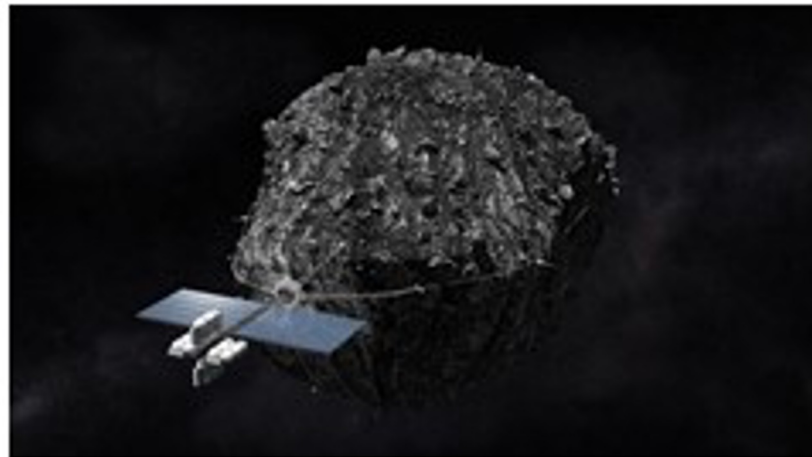




# Concepts Heritage



*Mining the Near Earth Asteroids:  
A Concepts Development and  
'Pre-Scoping' Study*



Draft V 1.1, November 2016

***A Concepts Development & Pre-Scoping Study*** gives the basis for *choosing viable missions*, & identifying knowledge gaps to be addressed, & sets the basis for the **Pre-Feasibility** and **Final (Bankable) Feasibility Studies**.

*A necessary step along the way...*

## The Technical and Economic Feasibility of Mining the Near-Earth Asteroids

A thesis submitted in fulfilment of the requirements for the award of the degree of

**Master of Science (Honours)**

from the

**University of Wollongong**

by

**Mark J Sonter, B.Sc., M.App.Sc.**

Department of Physics and Department of Civil and Mining Engineering

1997

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# INNOVATION

- Space mining from a terrestrial mining perspective
- Resource development phasing to develop a terrestrial resource project typically involves:

Prospecting mission – to determine the size of the resource and its accessibility.

Pilot plant / trial mine – to field trial the mining and extraction processes to demonstrate that the resource can be commercially recovered.

Commercial operation, delivery to markets, Optimisation, and expansion

Prof Andrew Dempster, UNSW: “***Spacecraft engineers design spacecraft and space missions, mine project engineers design resource businesses***”



# The Project Development Sequence

## ***Development Planning: Typical Terrestrial Resource Project***

- “Desktop” studies (eg open-literature data reviews):
  - Decide *what* mineral to look for, & *where*
  - Identify prospective areas & select potential targets
- Theory & field work to identify mineralized ‘prospects’
- Define ‘Inferred Mineral Resource’ (tonnes, grade)
- Concepts Dev & Scoping Studies (identify & review mining & processing options etc)
- Project planning: Pre-Feasibility Study - ‘PFS’ – possibly including Trial Mine
- Metallurgical testwork - possibly including Pilot Plant
- Definitive costing, major risks retired: Final (Bankable) Feasibility Study - ‘FFS/BFS’
- Funding & Project Go-Ahead (+ Licensing / Permitting!) *then-*
  - *finally* – Construct, Commission & COMMENCE OPERATION



*We are about here*

**-- All Totally Applicable to Space Resources Projects**



## The Prospecting Phase is Critical

- We need to confirm to investors that:
  - Raw resources actually exist
  - This can be done privately / commercially
  - A commercial business case can be established
- The Opportunity
  - To be in the lead in the race to Mars
  - To attain first mover status and advantage
  - Demonstrate that private investors can make a difference

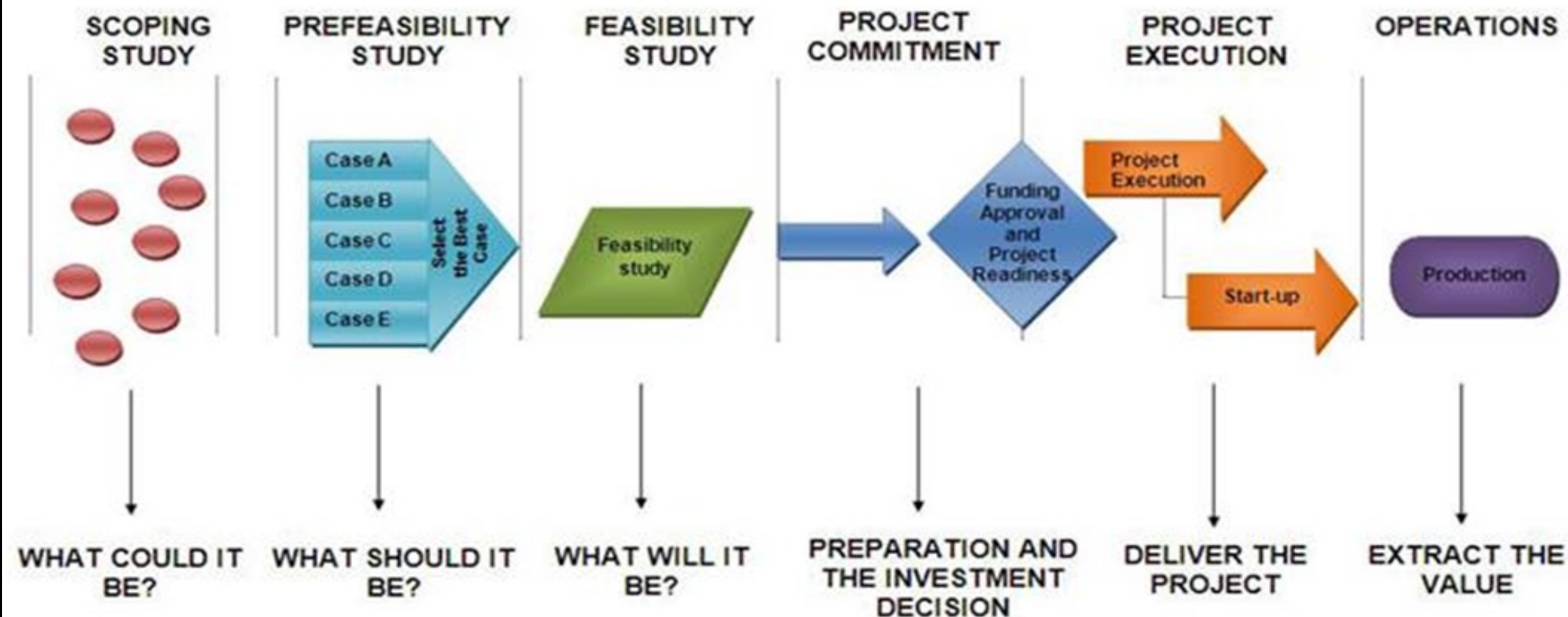


## Resource Evaluation Module

- Something that can “kick the dirt and have a look”
- Collect data for investment decision making
- Material cohesion and handling characteristics
- Shift from “pure science” to “applied science”
- Low cost, robust, COTS to max etc etc
- Limiting “new” equipment
- Thinking about what investors want to see
- Attract long term project partners



# Project Discipline: Studies Sequence to Manage Risk



Proven use in terrestrial resources projects (industry best practice)

Commercial focus, with gateways justifying further expenditure

Refine risk and quantify cost/time/quality iteratively

Applicable '*a fortiori*' for development of space mining projects



## OER Long Term Vision

Resource industries in space supporting  
Humanity's expansion into the Solar System...



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